SOTR FOR INDUCTION MOTORS

1. Technical Specifications:

The motors shall be capable of developing specified rated output at extreme environmental conditions, ambient temperature, voltage and frequency. While developing the rated output at such extreme conditions, the temperature rise of the motor shall be maximum 10 deg C higher than the permitted temperature rise at nominal voltage, frequency and temperature. The motors are to be manufactured for satisfactory performance under the following conditions and input supply characteristics /specifications:

(a) **Rated voltage** — 380V, 415V or 440V

(b) **No of phases** — 3(Three) 3 wire supply system

(c) **Voltage Tolerance**

i)	Steady state	+ 0.5% at all load.
ii)	Voltage range	15% to + 10%
iii)	Recovery time	1 second. (one second)

(d) **Frequency**

i)	Nominal frequency	50 Hz or 60 Hz.
ii)	Constant load tolerance	+ 0.5 Hz or + 1.0%
iii)	Load range tolerance	+1 Hz or + 2.0%
iv)	Transient	+ 2.5 %
v)	Time of recovery transient	2 Sec to within 1% of
vi)	Frequency range	+/- 3%

(e) **Cooling** — Air Cooled

(f) **Enclosure** — IP 56-Motors installed below deck

IP 57-Motors installed on weather deck

IP 58-Submersible motors upto 10 mtrs.

IP 68- Submerged beyond 10 mtrs.

(g) **Frequency at rated load** - 50 / 60 Hz

(h) **Power factor** — 0.7 lagging upto 5 KW

0.8 lagging above 5 KW

(i) **Rating**

Rating of motor shall be normally continuous rating. Only for specific application short term rating will be specified in SOTRs/TSP documents.

(j) **Efficiency**

Motor should conform to efficiency class mentioned at table 1 to 4 of IS 12615: 2004

For 3-phase motors the terminal markings, phase sequence and rotation are to be strictly in accordance with BS 4999 (Part 108). In case of motors designed for rotation in either direction (fitted with bi-directional fans) the clockwise direction is to be obtained by connecting U, V, W to A, B, C in accordance with BS 4999. Reverse direction can be achieved by reversal of one pair of the supply connections. See NES 627 for direction of rotation arrow. The direction of rotation is that observed when facing the drive end.

(k) **Starting Current**

a) The value of starting current shall not exceed 6 to 7 times the full load current for motors of capacities up to 75KW and 4 to 5 times full load current for motors of capacities above 75KW. These values are applicable to direct on line starting only. No positive tolerance is allowable on starting current. For Star-Delta/Reactive type starters, the starting current for motors with star-delta starters should not be more than 3 times of rated current. In order to limit the starting current values in line with standardised range of alternators on IN Ships, D.O.L starters shall be used for motors upto 10 KW rating.

b) If the requirement of Clause 0533 cannot be met with Direct-on-Line starting, proposals are to be submitted to NHQ/DEE for a soft starter, star delta type, or two-step starter of Auto-Transformer type.

(l) **Stator and Rotor**

(a) The laminated stator core is to be positively locked to prevent axial and rotational movement. The outer surface of the laminations must not form part of the enclosure.

(b) Cage rotors shall be cast in construction. Built up rotors with end rings brazed or welded to the bars in slots can also be permitted in specific cases. Cage materials shall be non brittle and resistant to salt, water and oil.

(c) The rotor core assembly is to be positively located on the shaft and must not become loose under the action of fluctuating torque vibration etc.

(d) The rotor core plate must be compressed axially between end plates and held rigidly in place. Axial, movement of the core assembly must be prevented.

(e) Adequate measures such as skewing of slots should be taken to prevent cogging or crawling. Where the reduction of noise is of prime importance, the slot should be skewed one slot pitch.

(f) Open or semi closed slots should normally be provided to facilitate easy repair, and the slot opening should be as small as possible consistent with the type of winding.

Windings and Internal Connections:

(a) All rigid and flexible conductors forming connections to or between windings are to be insulated using class `F' insulating materials. Connections should be as short as possible and adequately supported against shock, vibration and faulty conditions.

(b) Where rectangular section conductors are used, they are to be in accordance with IS 1897. Corners are to be finished to the approved radiations.

(c) The windings of stator and rotor shall be composed of form wound concentric coils or individual coils. Except for bar windings, each coil is to consist of continuous length of conductor without joints. Overhangs are to be adequately supported.

(d) Stator connection rings, where fitted, are to be sited at the non-drive end.

(e) Where called for, Hot spot temperature sensors are to be incorporated in proto-type or first production motors, so that hot spot temperature can be sensed during type tests.